

LUXE - Laser Update

LUXE Meeting, November 8th 2018

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Recent Funding (granted)

Helmholtz Innovationspool Funding

- > Supports laser activities for LUXE
- > partners: DESY, Jena and Dresden
- > 3 years, starts Jan. 2019

- > DESY: 1 PhD, 1 PostDoc, looking for candidates
- > DESY PostDoc: coordinate laser design and activities
- > DESY PhD: develop new pulse length measurement

- > Jena: develop intensity characterization (talk C. Rödel)
- > Dresden: laser contrast

Additional Funding (proposal submitted)

BMBF Verbundforschung

- > Just submitted by Univ. Hamburg, Univ. Jena, Univ. Düsseldorf, Dresden
- > Supported by DESY and GSI
- > 1.5 M€ total volume
- > To develop advanced laser diagnostics and characterization
- > Targets laser-plasma acceleration but overlaps 100% with LUXE requirements

Collaboration

Main challenge

- > Reliable & reproducible laser operation
- > Well-characterized laser pulse on target
- > (Not so much the laser energy)

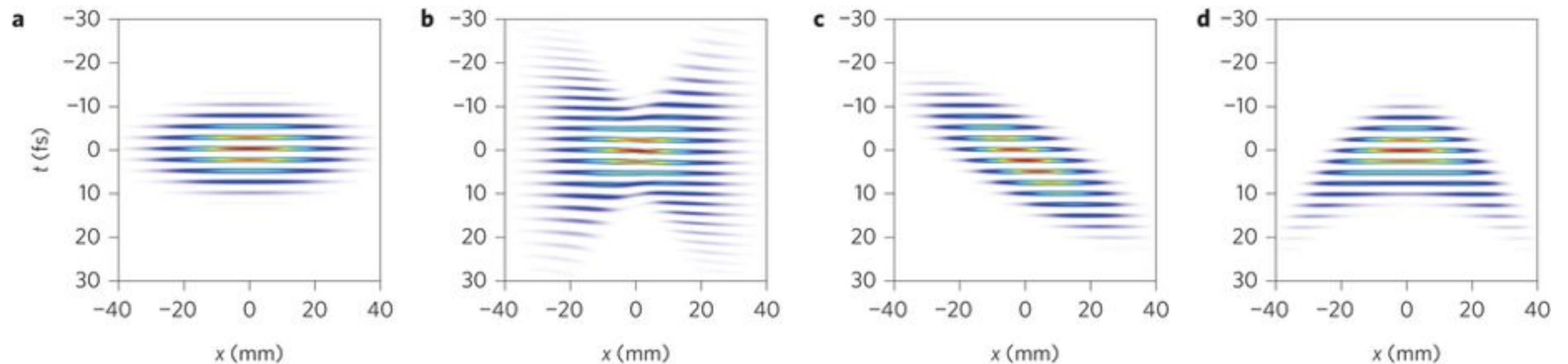
What we need can not be bought off the shelf.

Getting the team together

- > Discussed LUXE with major German partners in laser physics
- > Main contacts: Dresden (U Schramm), Jena (MC Kaluza, M Zepf), Hamburg (I Hartl, AR Maier)
- > Plan joint meeting early 2019 to kick off, discuss diagnostics, laser design

Example: Pulse length measurement

$$E(\mathbf{r}, t) = E(\mathbf{r}) \times E(t)$$

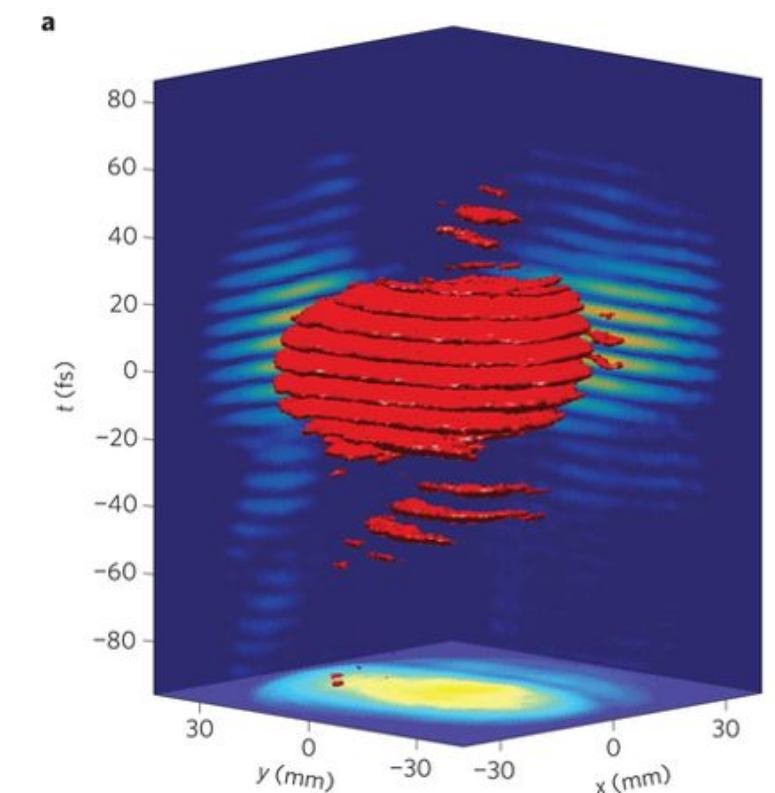


Different spatio-temporal couplings. From Nat. Photon 10, 547 (2016)

Laser pulse length measurement

- > today, basically all methods to measure pulse length assume that time and spatial dependence can be separated
- > example: FROG, GRENOUILLE, WIZZLER, ...
- > That is rarely true, and if there is a distorted pulse, which features spatio-temporal couplings, these methods then provide a wrong answer.

Recently, several methods have been proposed to measure the laser pulse full-3D E-Field distribution, for example, using spatially-resolved Fourier spectroscopy. Little hardware cost, but complex reconstruction algorithms & difficult to interpret, ... yet necessary.



*3D intensity distribution.
Nat. Photon 10, 547 (2016)*

M. Miranda et al., Opt. Lett. 39, 5142 (2014)
G. Pariente et al., Nat. Photon. 10, 547 (2016)